A NOVEL APPROACH TO ATMOSPHERIC PROFILING WITH A DOWN-LOOKING MOUNTAIN-BASED OR AIR-BORNE GPS RECEIVER

CINZIA ZUFFADA, George A. Hajj, E. Robert Kursinski

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, CA 91109, USA

cinzia@cobra.jpl.nasa.gov

ABSTRACT

Space-based GPS measurements, obtained by a receiver in a low-Earth orbit tracking GPS satellites occulting behind the Earth's atmosphere, yield accurate, high resolution profiles of refractivity, temperature and water vapor. A GPS receiver on a mountain top or an airplane with a "downward-looking" field of view toward the Earth's limb is a novel concept which is presented here. We describe a generalized raytracing inversion scheme which can be used for atmospheric profiling when occultation data are acquired with a receiver inside (e.g., on mountain top) or outside (i.e., in space) the atmosphere. In this scheme, spherical symmetry is assumed for the atmosphere and the refractivity is modeled as piecewise exponential, with scale height changing from one atmospheric layer to the next. Additional refractivity data derived from a model might be introduced above the receiver as an *a priori* constraint, and are treated as properly weighted additional measurements. The exponential scale heights and a normalizing value of refractivity are retrieved by minimizing, in a least-square sense, the residuals between measured bending angles and refractivity and those calculated based on the exponential model and raytracing. Our findings suggest that accurate profiles of refractivity at heights ranging from the Earth's surface to slighly above the receiver location can be derived by GPS data collected from within the atmosphere. This new remote sensing approach provides a relatively dense coverage of high vertical resolution profiles of refractivity in the region around the receiver, yielding valuable information on boundary layer structure and complementing the columnar moisture data from upward looking receivers.